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CORUNDUM MINING IN THE PIEDMONT PROVINCE OF PENNSYLVANIA

Nancy C. Pearre

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CORUNDUM MINING IN THE PIEDMONT PROVINCE OF PENNSYLVANIA

by Nancy C. Pearre
U. S. Geological Survey

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FOREWORD

The story of corundum is another chapter in Pennsylvania's rich history of mineral deposits. The Bureau of Topographic and Geologic Survey believes that a review of the mining record and geological conditions of corundum in Pennsylvania is desirable in the light of new techniques and principles. While mining activity in this commodity is now dormant in the State, Miss Pearre's continuing study in the perspective of the overall Piedmont Province is a fine contribution.

Genevieve Blatt

Genevieve Blatt, Secretary
Department of Internal Affairs

July, 1958

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ILLUSTRATION

FIGURE 1. Corundum mines in the Piedmont Province of Pennsylvania 3

CORUNDUM MINING IN THE PIEDMONT PROVINCE OF PENNSYLVANIA[1]

by

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ABSTRACT

In Chester and Delaware Counties, Pa., corundum occurs in sodium-rich pegmatites that are closely associated with serpentine rocks. At various times from about 1839 until 1892 the corundum was collected from the surface or mined and used by the abrasives industry. Considerably more than 650-750 tons of high-grade ore and concentrates was produced. The increased use of artificial abrasives has diminished the demand for natural corundum, and interest in the small, irregular Pennsylvania deposits is at present largely historical or mineralogical.

INTRODUCTION

Corundum, an aluminum oxide (Al_2O_3), is one of the hardest of natural minerals, second only to diamond. Because of its hardness, it was widely used as an abrasive and polishing material before artificial abrasives were developed in the 1890's. Corundum grinding wheels are still preferred for grinding certain types of castings, and corundum is still considered essential to the optical industry for lens-grinding (Chandler, 1956).

Corundum occurs in both crystalline and massive form, has an uneven to conchoidal fracture and a notable rhombohedral parting that makes sharp fragments when the corundum is ground. Sapphire and ruby are rare gem varieties. Corundum occurs in many diverse environments, but it is most commonly associated with silica-deficient rocks —in the Piedmont physiographic province of Pennsylvania (see Fig. 1), these are sodium-rich pegmatites closely associated with metamorphosed ultramafic rocks (serpentine[2]) and characteristically contain little or no quartz and mica.

At various times from about 1839 until 1892 corundum was produced from several mines and from haphazard finds in fields and road gutters in Chester County and to a lesser extent in Delaware County. It was at first shipped to England, but later was ground at a local mill for use in the abrasives industry. Most important were the mines northeast of Unionville in Newlin Township, Chester County (see location map), generally referred to collectively as the Unionville mines or Corundum Hill. Other pits and small mines were in Delaware County, west and southwest of Media, Middletown Township, and near Village Green, Aston Township (see map).

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[1] Publication authorized by the Director, U. S. Geological Survey.

[2] Use of "serpentine" rather than "serpentinite" for these altered ultramafic rocks conforms with usage in the literature on eastern Pennsylvania. Most geologists who have worked in the area have grouped under the general term serpentine, rocks that range in composition from partly altered dunite, peridotite, and pyroxenite, through serpentinite as defined by petrographers, to soapstone or steatite.

Corundum was also produced at Shimerville, 2 miles southeast of Macungie, Lehigh County, north of the Piedmont province. For a discussion of this locality the reader is referred to Stone (1939, p. 12-13).

Other corundum occurrences, of mineralogic interest only, have been reported elsewhere in the Pennsylvania Piedmont (Gordon, 1922). They are listed below, along with page references to Gordon's report:

Chester County

1. E. Nottingham Twp., 1½ mi. northeast of Chrome, roadside exposures (p. 170).
2. Newlin Twp., 1 mi. north of Corundum Hill (p. 174).
3. W. Nottingham Twp., 2 mi. southwest of Fremont, crystals in albite (p. 181).

Delaware County

4. Middletown Twp., ¾ mi. northeast of Lima, Smedley's limonite mine (p. 190).
5. Middletown Twp., 1½ mi. northeast of Lima, at road forks, Williams' farm (p. 190).
6. Middletown Twp., Mineral Hill, exposures and streambed (p. 191).
7. Middletown Twp., Scherz's farm, just west of map loc. 10 (p. 192).
8. Middletown Twp., Hibbard's farm, west of map loc. 7 (p. 192).
9. Middletown Twp., north of Elwyn Sta., near Ridley Creek, east of map loc. 9 (p. 192).
10. Upper Providence Twp., Reese's farm on Ridley Creek, east of Sycamore Mills (p. 200).

Montgomery County

11. Lower Merion Twp., hillside above Lafayette soapstone quarry, west side of Schuylkill River (p. 213).

Philadelphia County

12. Chestnut Hill (p. 223).

MINING HISTORY

The identification of corundum near Unionville is attributed to John and Joel Bailey about 1825. During the years that followed, corundum masses in the soil were found from time to time by well-diggers and plowmen, and the hardness that later made the corundum valuable at first proved no more than a nuisance. Futile attempts were made to drill holes in it and blast it; finally holes were dug in the soil nearby and the lumps were buried out of reach of a plow (Willcox, 1883, p. 349).

According to a West Chester newspaper account,[1] the representative of an English plate glass firm came to the United States in 1836 or 1837 in search of corundum for glass-cutting. As a result of his visit

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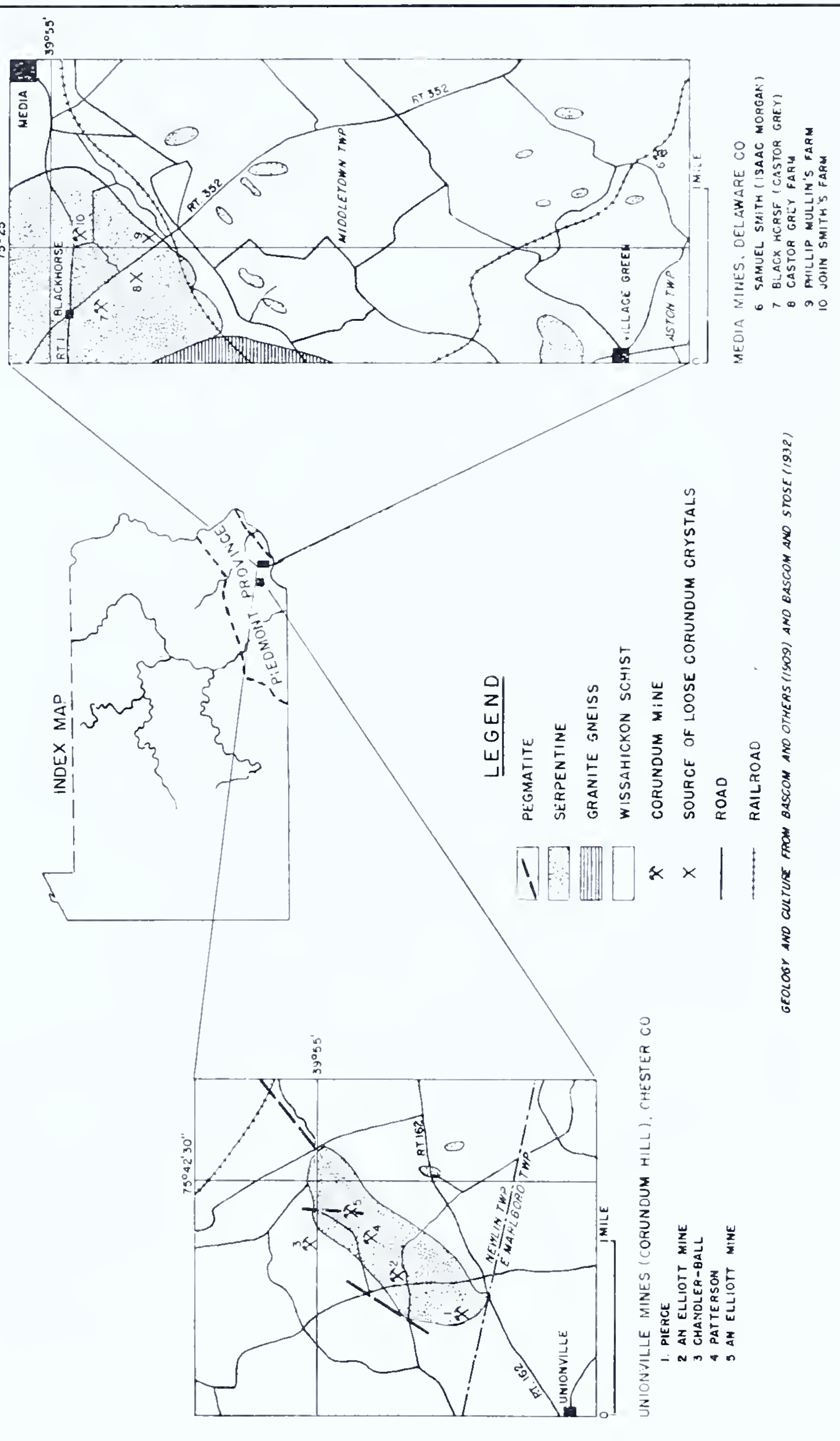
[1] The American Republican, April 29, 1873.



GEOLOGY AND CULTURE FROM BASCOM AND OTHERS (1909) AND BASCOM AND STOSE (1932)

FIGURE 1 CORUNDUM MINES IN THE PIEDMONT PROVINCE OF PENNSYLVANIA

Lewis White Williams, a mineralogist, bought some property northeast of Unionville where a well had been abandoned when the diggers struck corundum (Fig. 1, loc. 4?). He collected loose crystals and small masses of corundum along the north slope of the serpentine ridge and in 1839 shipped 6 or 7 tons to England. The well was opened as a corundum mine in 1844, but apparently was not very successful, for at a depth of 50 feet the corundum mass became too thin to mine. Williams continued to collect loose corundum from the vicinity and shipped about 50 tons of it. A single mass shipped in 1848 is said to have weighed between 4,000 and 5,200 pounds.

The Williams property was later acquired by a number of different people who apparently tried to find corundum on it. In 1864 Johnson Patterson sold one ton of corundum for $60 and planned to mine more corundum and some feldspar on the farm that winter. The following fall, in Kennett Square, John Leslie sold 4½ tons of corundum from the Williams farm, also for $60 a ton.[2]

In 1867 Samuel Pusey, Spencer Chandler, and George Ball of Wilmington, Del., purchased the farm and prospected for sometime without success. In 1872 they consulted a Delaware County mineralogist, John H. Smedley, who traced scattered boulders to a large mass of corundum more than 10 feet long and 5 feet wide at the northern edge of the serpentine (Fig. 1, loc. 3). Delivered at the railroad station, the corundum reportedly brought $300 a ton as mined and $500 a ton when crushed. Production amounted to about 150 tons. Correspondence[3] between the owners and their agent indicates that a certain amount of associated diaspore decreased the value of the corundum, and also that the deposit was mined out by 1875 or 1876. The shaft (loc. 3) was then 90 feet deep. Pusey withdrew from the firm, but Chandler and Ball continued exploration for a few years, sinking a new shaft and tunnelling extensively, though apparently without much luck.

About 1875 corundum mining began on the Pierce farm, also near Unionville. The specific location of this mine can only be inferred from vague newspaper references; a possible location is shown on Figure 1 (no. 1). By 1879 Joshua Pierce had stopped operations because of water in his mine. He sold 3 tons of corundum in 1881, probably from a previously mined supply, and had 5 additional tons on hand. In 1885 a new corundum quarry was reportedly opened on Nathan Pierce's farm, near the old corundum mine—presumably the same Pierce farm. Mining continued at least through 1888 and seems to have been successful for a time.

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[2] The Village Record, West Chester, Pa., Nov. 22, 1864 and Oct. 3, 1865.

[3] On file at the Chester County Historical Society, West Chester, Pa.

Several of the mines at Unionville were operated intermittently between 1879 and 1892 by Captain John W. Elliott, who supervised work for the following companies in succession: The Sapphire Mining Company, Unionville Corundum Mining Company, Northbrook Mining Company, American Corundum Mining Company, Chester County Corundum Company, and Abrasives Material Company of Pa. The mines shown as numbers 2 and 5 on Figure 1 probably were opened in this period, and possibly other mines not shown on the map were included. In 1881 the Unionville Corundum Mining Company bought and began to mine corundum on the farm of Howell Bailey, an adjoining property. By 1882 a large part of the domestic corundum production was coming from Chester County (U. S. Geol. Survey, 1883, p. 477). The mines were idle for a few years but were reopened in 1886, and newspaper accounts during the following years reflect the success of Capt. Elliott's operations: work progressed at a "lively rate"; new machinery was installed; new buildings were built. In 1887 the company reported production as 600 to 700 pounds of ore[1] per day. By 1889 the shaft was 160 feet deep and plans were being made to sink two new shafts "at once." The Daily Local News of West Chester (Dec. 4, 1889) spoke of Chester County as "notorious in every manufacturing district in the country" for "the finest corundum ever mined in the world." After being hand-sorted, the corundum was ground and sized for use in abrasive wheels.

In 1890 Elliott and his associates leased the Pierce farm and mined some corundum there. Last production from the Unionville mines was in 1892. Some years afterward, one of the Elliott mines (Fig. 1, loc. 2) was leased for three months by William S. Gray and a friend, who reported finding no more than a few stray pieces of corundum (Stone, 1939, p. 12).

The only other corundum workings in the Pennsylvania Piedmont were in Middletown Township, Delaware County, west of Media and about one-quarter of a mile southeast of the old Black Horse Inn (Fig. 1, loc. 7). Known as the Black Horse mine or Castor Grey's mine, the pits were worked sometime between 1875 and 1882 for a period of about eighteen months, and the corundum was shipped to New York. According to Stone (1939, p. 12), the mine consisted of three shafts, two about 8 feet square and 30 feet deep, and another smaller one; according to Kunz (1885, p. 735), however, one shaft was 60 feet deep.

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[1] Insofar as can be judged, the word "ore" as used in contemporary descriptions of the Pennsylvania corundum mines, and therefore in this report, means hand-sorted, marketable corundum in rock form (before grinding) and not pegmatite containing scattered crystals and masses of corundum that had to be concentrated to a marketable grade.

All these openings have been filled and the field cultivated for some time.

Farther south on the Castor Grey farm (Fig. 1, loc. 8), crystals of corundum, 4 to 6 inches long, were found in the soil and in road gutters. East of the road, on Phillip Mullin's farm (loc. 9), crystals were plowed up and collected after heavy rains (Gordon, 1922, p. 192). A pit dug for corundum on the John Smith farm, about half a mile east of the Black Horse Hotel intersection (loc. 10), met with little success and was soon abandoned (Stone, 1939, p. 12). Other small-scale efforts to produce corundum were made from time to time in the area while the mineral was in considerable demand.

PRODUCTION AND VALUE

Production of corundum in the Pennsylvania Piedmont was small, although considerably larger than the 650-750 tons of high-grade ore and concentrates accounted for in the following piecemeal records, which end in 1882 and therefore omit what was apparently the most productive period at Unionville (1886-1892). Sporadic shipments totalling about 50 tons are recorded from the Unionville mines between 1839 and 1866. In 1873 about 150 tons was produced by Chandler and Ball, and in 1881 the Northbrook Mining Company had 200 tons of ore ready for shipment and reported several hundred tons of inferred ore[1]. Production from Chester and Delaware Counties during 1882 was probably between 200 and 300 tons of corundum ore (U. S. Geol. Survey, 1883, p. 477). There is no record of production from the extensively worked Pierce farm, except the 8 tons Pierce had for sale during one of the inactive years; however, in July, 1887, Nathan Pierce was reportedly producing more than his neighbor, Captain Elliott, and only three months later Elliott's mines were producing 600 to 700 pounds of ore a day.[2]

Near Media, the Black Horse mine produced "fully 50 tons" of corundum between 1875 and 1882 (Kunz, 1885, p. 735). The "few hundred pounds" said to have been mined on the farm of Castor Grey (Willcox, 1883, p. 348) were probably loose crystals collected from the soil on the southern part of the farm (Fig. 1, loc. 8). No figures exist for production on the other farms in Delaware County where corundum was collected in the wake of the plow and in road gutters.

In 1866 corundum from Unionville sold for $60 a ton. Willcox (1883, p. 349) reports that shortly afterwards the demand became so great that the price was as high as 50 cents per pound ($1,000 a ton). In 1873-1875 Chandler, Ball, and Company were able to get between $200 and $500 a ton. By 1882 crude rock of unknown grade, probably containing a high percentage of corundum, brought only $10 to $15 a ton; ground corundum, 12 to 15 cents a pound, or $240-$300 a ton (U. S. Geol. Survey, 1883, p. 477).

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[1] Daily Local News, West Chester, Pa., Aug. 16, 1881.

[2] Daily Local News, West Chester, Pa., July 13 and Oct. 22, 1887.

GEOLOGIC OCCURRENCE

The corundum is irregularly distributed as granular masses and euhedral crystals embedded in the plagioclase feldspar of sodium-rich pegmatites. The pegmatites are intrusive either into serpentine bodies or at the contact of serpentine and schist. A zone containing white foliated talc, actinolite, and chlorite is commonly developed between the pegmatite and the serpentine. Near the surface the corundum-bearing feldspar is decomposed, and at the surface soil formed by weathering of the pegmatites and their enclosing rocks contains residual boulders and loose crystals of corundum. Gordon (1921) discusses the geology of corundum-bearing pegmatites.

Other aluminous minerals occur with the corundum, particularly margarite, damourite, zoisite, sillimanite, and kyanite, and less commonly diaspore, gibbsite, spinel, and tourmaline. Some of these minerals were formed by alteration of the corundum; others are probably primary in origin.

At the Unionville mines (Gordon, 1921, p. 183) white, brownish-white or gray crystals and blue-black masses of corundum were found in rock consisting of sodium-rich plagioclase feldspar, black or bluish- to brownish-green tourmaline, margarite, and euphyllite (a basic sodium and potassium mica for which Unionville is the type locality). The plagioclase varies from granular white albite to yellowish- or brownish-white oligoclase. A few blue and red corundum crystals of near-gem quality were reportedly found at the mines.[1]

The Chandler-Ball mine (no. 3) reportedly worked a solid mass of corundum and margarite that was 14 feet long, 7 feet wide, and 54 feet deep (Jefferis, 1892, p. 188; Gordon, 1921, p. 183). A zone of foliated talc separated it from the serpentine. On one side of the corundum mass was a 2-inch coating of fawn-colored diaspore 3 feet long and 2 feet wide, with well-formed crystals on the surface. Crystals of corundum were sheathed by margarite or damourite, and margarite formed yellowish or pinkish foliated masses and secondary scaly aggregates around cores of corundum. Laminated masses and clear crystals of diaspore were associated with the pearly plates of margarite and were penetrated by translucent bluish or greenish prismatic crystals of tourmaline. Although the presence of diaspore lowered the value of the corundum, these diaspore crystals were greatly valued by mineralogists as they are among the finest ever found, and Kunz (1885, p. 738) suggested that they were potential gems, closely resembling topaz in appearance.

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[1] Daily Local News, West Chester, Pa., Aug. 26, 1881.

The corundum deposits in Delaware County were largely white to brown or gray crystals averaging about 6 cm. long, found loose in the soil or in road gutters. At the Black Horse pits white to brown, slender, bypyramidal crystals of corundum occurred in granular white albite-oligoclase rock (Gordon, 1921, p. 182), and the mine was noted for its asteriated crystals. Masses of corundum-bearing rock were irregular, less than 5 feet in diameter, and pinched out at depths of about 30 or 60 feet.

Other minerals associated with the corundum-bearing pegmatites include zoisite (commonly) and black spinel (rarely). White foliated talc, greenish actinolite, and much dark-green chlorite are common adjacent to the pegmatite. Large yellowish-green plates of jefferisite are also found. Gibbsite, an aluminum hydroxide, forms a thin coating of small mamillary incrustations on albite (Genth, 1873, p. 373). Also reported from the corundum mines are "indianite" (a granular variety of anorthite), antigorite, and damourite. Unionville was the type locality for other mineral varieties beside euphyllite. These are given by McKinstry (1921) as "pattersonite" (a hydrous magnesia-iron mica from Johnson Patterson's farm), "lesleyite" (a mixture of damourite and corundum from the John Lesley farm), "unionite" (a variety of white zoisite), and "corundellite" (later shown to be margarite).

Genth (1873, p. 380-381) describes and gives analyses of corundum more or less completely altered to sillimanite from localities in Delaware County. At one place it is associated with kyanite and staurolite twins.

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